

1 **WHAT IS CLAIMED IS:**

2 1. An uninterruptible power supply having an input connected to an input power
3 source and an output connected to a critical load, the uninterruptible power supply
4 comprising:

- 5 a) a utility disconnect static switch comprising two silicon controlled
6 rectifiers connected in anti-parallel coupled between the input and an
7 input bus;
- 8 b) a battery bus;
- 9 c) an inverter coupled between the battery bus and the output; and
- 10 d) an inverter controller that, upon detection of an input power source fault
11 causing an input voltage magnitude increase, controls the inverter to
12 generate on the input bus a voltage of the same polarity and greater
13 magnitude than the input voltage, thereby commutating the utility
14 disconnect static switch.

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16 2. The uninterruptible power supply of claim 1 further comprising:

- 17 a) a transformer having first and second windings, the first winding series
18 coupled between the utility disconnect static switch and the output,
19 and the second series winding having a first terminal coupled to
20 ground;
- 21 b) a series inverter coupled between a second terminal of the second winding
22 and the battery bus; and
- 23 c) a series inverter controller that, upon detection of an input power source
24 fault causing an input voltage magnitude increase, controls the series
25 inverter to generate on the input bus a voltage of the same polarity and
26 greater magnitude than the input voltage, thereby commutating the
27 utility disconnect static switch.

1 3. A method of preventing fault propagation through a utility interactive UPS having
2 an inverter and a utility disconnect static switch with an input terminal supplied with an
3 input power signal and an output terminal, the method comprising the steps of:

4 sensing a characteristic of the input power signal;
5 detecting a change in the sensed characteristic indicating a fault that causes an
6 increase in the voltage of the input power signal;
7 controlling the inverter to generate on the output terminal of the utility disconnect
8 static switch a voltage having a polarity the same as and a magnitude
9 greater than the faulted input voltage, thereby commutating the static
10 switch.

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12 4. The method of claim 3 wherein the UPS comprises a second inverter, the method
13 further comprising:

14 controlling the second inverter to generate on the output terminal of the utility
15 disconnect static switch a voltage having a polarity the same as and a
16 magnitude greater than the faulted input voltage, thereby commutating the
17 static switch.

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19 5. The method of claim 3 wherein the sensed characteristic is a voltage across the
20 static switch.

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22 6. The method of claim 3 wherein the sensed characteristic is a current through the
23 static switch.

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25 7. The method of claim 4 wherein the sensed characteristic is a voltage polarity
26 across the static switch.

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28 8. The method of claim 4 wherein the sensed characteristic is a current direction
29 through the static switch.

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1 9. An uninterruptible power supply having an input connected to an input power
2 source and an output connected to a critical load, the uninterruptible power supply
3 comprising:

- 4 a) a utility disconnect static switch coupled between the input and an input
5 bus, the switch two silicon controlled rectifiers connected in anti-
6 parallel;
7 b) a series inverter coupled between the input bus and a battery bus;
8 c) a primary inverter coupled between the battery bus and the output; and
9 d) a series inverter controller that, upon detection of an input power source
10 fault causing an input voltage magnitude increase, controls the series
11 inverter to generate on the input bus a voltage of the same polarity and
12 greater magnitude than the input voltage, thereby commutating the
13 utility disconnect static switch.

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15 10. A method of preventing fault propagation through a utility interactive UPS having
16 a series inverter and a utility disconnect static switch with an input terminal supplied with
17 an input power signal and an output terminal, the method comprising the steps of:

18 sensing a characteristic of the input power signal;
19 detecting a change in the sensed characteristic indicating a fault that causes an
20 increase in the voltage of the input power signal;
21 controlling the series inverter to generate on the output terminal of the utility
22 disconnect static switch a voltage having a polarity the same as and a
23 magnitude greater than the faulted input voltage, thereby commutating the
24 static switch.

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26 11. An uninterruptible power supply having an input connected to an input power
27 source and an output connected to a critical load, the uninterruptible power supply
28 comprising:

- 29 a) a utility disconnect static switch comprising two gate commutated
30 switching devices connected in anti-parallel coupled between the input
31 and an input bus;

- 1 b) an utility disconnect static switch controller that, upon detection of an
2 input power source fault causing an input voltage magnitude increase,
3 opens the gate commutated switching devices.
4 c) a clamping circuit coupled to the gate commutated switching devices to
5 minimize the transient voltage caused by opening the fast utility
6 disconnect static switch.

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8 12. The uninterruptible power supply of claim 11 wherein the gate commutated
9 switching devices are power transistors.

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11 13. The uninterruptible power supply of claim 11 wherein the gate commutated
12 switching devices are gate turn off thyristors.

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14 14. The uninterruptible power supply of claim 11 wherein the clamping circuit further
15 comprises:

16 a first diode having a cathode coupled to an input side of the fast utility
17 disconnect static switch and an anode coupled to a negative battery bus;
18 a second diode having an anode coupled to the input side of the fast utility
19 disconnect static switch and a cathode coupled to the positive battery bus;
20 a third diode having an anode coupled to an output side of the fast utility
21 disconnect static switch and a cathode coupled to the positive battery bus;
22 and
23 a fourth diode having a cathode coupled to the output side of the fast utility
24 disconnect switch and an anode coupled to the negative battery bus.

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26 15. The uninterruptible power supply of claim 11 wherein the clamping circuit further
27 comprises:

28 a first diode having a cathode coupled to an input side of the fast utility
29 disconnect static switch and an anode coupled to a negative terminal of a
30 capacitor;

1 a second diode having an anode coupled to the input side of the fast utility
2 disconnect static switch and a positive terminal of the capacitor;
3 a third diode having an anode coupled to an output side of the fast utility
4 disconnect static switch and a cathode coupled to the positive terminal of
5 the capacitor; and
6 a fourth diode having a cathode coupled to the output side of the fast utility
7 disconnect switch and an anode coupled to the negative terminal of the
8 capacitor.

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10 16. The uninterruptible power supply of claim 11 wherein the clamping circuit further
11 comprises:

12 a first diode having an anode coupled to an input side of the fast utility disconnect
13 static switch and a cathode coupled to a first terminal of a capacitor;
14 a second diode having a cathode coupled to the input side of the fast utility
15 disconnect static switch and an anode coupled to a second terminal of the
16 capacitor;
17 a third diode having a cathode coupled to the first terminal of the capacitor and an
18 anode coupled to ground; and
19 a fourth diode having an anode coupled to the second terminal of the capacitor
20 and a cathode coupled to ground.

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22 17. The uninterruptible power supply of claim 11, wherein the clamping circuit
23 further comprises:

24 a first diode having an anode coupled to an input side of the fast utility disconnect
25 static switch and a cathode coupled to a first terminal of a first capacitor;
26 and
27 a second diode having a cathode coupled to the input side of the fast utility
28 disconnect static switch and a cathode coupled to a second terminal of a
29 second capacitor;
30 wherein the second terminal of the first capacitor and the first terminal of the
31 second capacitor are coupled to ground.

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2 18. The uninterruptible power supply of claim 11, wherein the clamping circuit
3 further comprises:

4 a first voltage limiting diode having a cathode coupled to an input side of the fast
5 utility disconnect static switch; and
6 a second voltage limiting diode having an anode coupled to an anode of the first
7 voltage limiting diode and a cathode coupled to ground.

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9 19. A method of preventing fault propagation through a utility interactive UPS having
10 a utility disconnect static switch comprising two gate commutated switching devices
11 coupled in anti-parallel, the static switch having an input terminal supplied with an input
12 power signal, the method comprising the steps of:

13 sensing a characteristic of the input power signal;
14 detecting a change in the sensed characteristic indicating a fault that causes an
15 increase in the voltage of the input power signal;
16 opening the static switch to disconnect the input power signal from the UPS.

18 20. The method of claim 19 wherein the sensed characteristic is a voltage across the
19 static switch.

21. The method of claim 19 wherein the sensed characteristic is a current through the
22. static switch.